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Physical Activity, Sedentary Lifestyle, and Lumbar Flexibility in Young Adults: A Cross-Sectional Study

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Abstract

Introduction: Lumbar flexibility is crucial in maintaining good posture, supporting daily activities, and preventing musculoskeletal disorders. However, the rising prevalence of sedentary lifestyles among students, characterized by prolonged sitting and minimal physical activity, may negatively impact lumbar flexibility. This study analyzes the relationship between physical activity and sedentary lifestyle on lumbar flexibility in young adults.
Methods: This research is a cross-sectional study involving a sample of 154 individuals selected based on inclusion criteria. Data were collected using the Physical Activity Questionnaire for Adolescents (PAQ-A), Sedentary Behavior Questionnaire (SBQ), and Modified Schober Test. Data analysis was performed using Spearman correlation tests.
Results: The analysis of the relationship between physical activity and lumbar flexibility showed a correlation coefficient of r = 0.036 with a p-value of 0.661, indicating a very weak relationship. Meanwhile, the relationship between sedentary lifestyle and lumbar flexibility had a correlation coefficient of r = -0.123 with a p-value of 0.130, indicating a weak negative correlation.
Conclusion: Physical activity and a sedentary lifestyle are related to lumbar flexibility, although the strength of this relationship is very weak. These results suggest further investigation to understand other factors contributing to lumbar flexibility in young adults.

Keywords: Physical Activity, Sedentary Lifestyle, Lumbar Flexibility

Introduction

Sedentary behaviour and a lack of physical activity are significant concerns among students, including physiotherapy students, who experience high screen time and prolonged sitting due to their demanding academic schedules. Data from the Basic Health Research (Riset Kesehatan Dasar) in 2018 indicate an increase in the prevalence of insufficient physical activity in Indonesia, rising from 26.1% in 2013 to 33.5% in 2018.[1,2]. The WHO also reports that a lack of physical activity is one of the leading causes of death worldwide, contributing to 6% of all mortality cases.[3]

The Ministry of Health of the Republic of Indonesia defines sedentary behavior as activities with low energy expenditure, typically below 1.5 metabolic equivalents (METs).[4] Students with low levels of physical activity tend to experience muscle imbalance in the trunk and impaired respiratory function.[5] Lifestyle changes and psychosocial factors upon entering university often lead to a decrease in physical activity, increasing the risk of musculoskeletal disorders, obesity, and postural issues.[6,7] Lumbar flexibility is crucial in daily activities such as bending, twisting the body, and lifting loads.[7]

The elements that contribute to flexibility include muscles, tendons, ligaments, and joint structures.[8] A lack of physical activity can lead to muscle stiffness and connective tissue rigidity in the joints due to muscle shortening or atrophy from infrequent active use.[9] As a result, individuals with low lumbar flexibility are at risk of experiencing postural disorders and lower back pain.[10]

Also, low flexibility increases the risk of muscle, ligament, or other soft tissue injuries due to strains exceeding their elastic limits.[11] Physiotherapy students, who spend much time sitting in class, completing assignments, and participating in practical sessions, often prefer passive activities such as lying down or using elevators over engaging in physical activity.[12] These habits can exacerbate lumbar flexibility and increase the risk of musculoskeletal disorders.[13]

In an academic environment, physiotherapy students often spend hours attending lectures, completing assignments, and participating in practical sessions, which prolongs their sedentary behavior. Coupled with using facilities such as elevators that reduce opportunities for active movement, this situation can further exacerbate lumbar flexibility. Therefore, exploring how physical activity and a sedentary lifestyle are related to lumbar flexibility among students is essential.

This study analyzes the relationship between physical activity and sedentary lifestyle on lumbar flexibility among the 2021 cohort of physiotherapy students at Universitas Muhammadiyah Surakarta. Specifically, this research will test whether there is a positive relationship between physical activity and lumbar flexibility and a negative relationship between sedentary lifestyle and lumbar flexibility. Thus, the results of this study are expected to provide deeper insights

into the impact of sedentary behavior on students and serve as a basis for interventions or programs aimed at increasing physical activity within the academic environment.

This research assumes that levels of physical activity and sedentary lifestyle influence lumbar flexibility among students. Specifically, this study hypothesizes that higher physical activity levels correlate with better lumbar flexibility. Conversely, a sedentary lifestyle characterized by prolonged sitting and minimal physical activity is anticipated to hurt lumbar flexibility. Therefore, this study seeks to demonstrate a positive relationship between physical activity and lumbar flexibility and a negative relationship between a sedentary lifestyle and lumbar flexibility among the 2021 cohort of physiotherapy students at Universitas Muhammadiyah Surakarta.

Methods

This study is analytical observational research using a cross-sectional approach. This design was chosen because it allows the researcher to measure the relationships between physical activity, sedentary lifestyle, and lumbar flexibility within a single period without intervention. This design is suitable for exploring correlations among variables in a specific population with efficiency in time and resources.

The independent variables in this study are physical activity and sedentary lifestyle, while the dependent variable is lumbar flexibility. This study was reviewed by the Health Research Ethics Commission (KEP-K) of the Faculty of Health Sciences at Universitas Muhammadiyah Surakarta. It was approved with ethical eligibility No. 761/KEPK-FIK/XII/2024.

The research was conducted on the campus of Universitas Muhammadiyah Surakarta, with data collection in December 2024. Data were gathered in classrooms and physiotherapy laboratories through scheduled sessions agreed upon with the participants.

The study sample consisted of 154 physiotherapy students from the 2021 cohort, recruited through announcements in student groups. The sampling method used was total sampling, which included the entire target population in that cohort. The inclusion criteria for this study included students who were willing to participate, in good physical health, and followed the research procedures as instructed. Meanwhile, the exclusion criteria included students unwilling to follow the research procedures, who had specific medical conditions that limited physical activity in the past week, were absent during the study, experienced pain while bending, or had a history of lower back injuries.

Data were collected simultaneously over one period using three main instruments: (1) the Physical Activity Questionnaire for Adolescents (PAQ-A) in Indonesian, which has been validated in previous studies; (2) the Sedentary Behavior Questionnaire (SBQ) in Indonesian, which has been validated by experts; and (3) the Modified Schober Test to measure lumbar flexibility, with a good flexibility value set as >20 cm.

Trained physiotherapists conducted the Modified Schober Test measurements to ensure the accuracy of the results and minimize bias. Before measurement, the assessors underwent standardized training to ensure consistency in the measurement procedures.

In this study, steps were taken to minimize bias. Flexibility measurements were conducted by assessors who were unaware of the respondents' questionnaire results to reduce subjectivity. Additionally, strict exclusion criteria were applied to mitigate potential bias from medical factors that could influence the results.

The sample size was determined based on calculations using the correlation analysis formula with a significance level of 5% and a test power of 80%, resulting in a minimum sample requirement of 140. With a total population of 154 students, total sampling was used to ensure that the study included all subjects meeting the criteria.

Data were analyzed using two main methods: (1) Univariate Analysis, which was used to describe the distribution and characteristics of each variable, and (2) Bivariate Analysis, using the Spearman-Rho test to examine the relationship between the independent and dependent variables. The Spearman-rho test was chosen because the data were not normally distributed, as confirmed by the Shapiro-Wilk normality test. To ensure the validity of the results, missing or incomplete data were excluded from the final analysis. This approach was used to maintain the accuracy of the findings and avoid bias due to inadequate information.

Results

To clarify the number of individuals at each stage of the study, a flow diagram of participant involvement is presented in Figure 1.

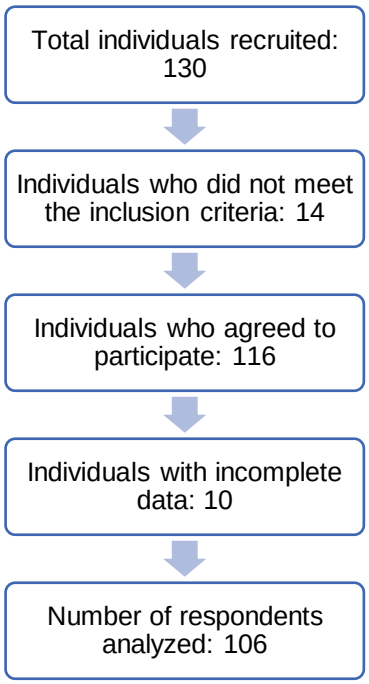

Figure 1. Flow Diagram of the Study

A total of 10 individuals had incomplete data and were excluded from the analysis. No data imputation was performed, and the analysis included only 106 respondents with complete data. The characteristics of the study respondents, including gender, level of physical activity, level of sedentary lifestyle, and results of lumbar flexibility measurements, are presented in Table 1.

Table 1. Description of Respondent Characteristics

Variable	n (%)
Gender	
Male	37 (24%)
Female	117 (76%)
Physical Activity	
Very Low	33 (21.4%)
Low	100 (64.9%)
Moderate	19 (12.3%)
High	2 (1.3%)
Very High	0 (0%)
Sedentary Lifestyle	
Low	46 (29.9%)
Moderate	51 (33.1%)
High	57 (37%)
Lumbar Flexibility	
>20 cm	149 (96.8%)
<20 cm	5 (3.2%)

From the table above, most respondents are female (76%). Most respondents have low levels of physical activity (64.9%), while only 1.3% fall into the high physical activity category, and none are classified as very high. For the sedentary lifestyle variable, the distribution of respondents is relatively balanced, with the high category (37%) being the most dominant. The results of the lumbar flexibility measurement using the Modified Schober Test indicate that 96.8% of respondents have normal flexibility (>20 cm), while 3.2% show abnormal flexibility (<20 cm). The average lumbar flexibility is 21.81 cm, with a minimum value of 18.0 cm and a maximum of 24.5 cm.

Table 2. Correlation Between Variables

Correlation Variables	r	p
Physical Activity vs. Lumbar Flexibility	0.036	0.661
Sedentary Lifestyle vs. Lumbar Flexibility	-0.123	0.130

Based on the Spearman-rho analysis results, the relationship between physical activity and lumbar flexibility shows a p-value of 0.661, indicating no significant relationship. The obtained correlation is r = 0.036, suggesting a very weak relationship. Nonetheless, the trend shows that as a person's level of physical activity increases, so does their lumbar flexibility.

Meanwhile, the relationship between a sedentary lifestyle and lumbar flexibility shows a p-value of 0.130, which is also insignificant. The negative correlation obtained (r = -0.123) suggests that as a person's sedentary lifestyle increases, their lumbar flexibility decreases, but this relationship is weak.

Discussion

After collecting data from 154 respondents, specifically Physiotherapy students from the 2021 cohort at Universitas Muhammadiyah Surakarta, it was found that 33 individuals (21.4%) had a very low level of physical activity. Most respondents, totalling 100 individuals (64.9%), exhibited a low level of physical activity, followed by two individuals (1.3%) with a high level of physical activity. In contrast, none of the respondents fell into the very high physical activity category. This data was obtained through the PAQ-A questionnaire, which assessed the respondents' physical activity over the past seven days.

Previous research indicated that 36.3% of students were not actively engaged in physical activity, while 63.7% were active in physical activities.[14] According to the Ministry of Health (2018), physical activity is categorized based on intensity and the level of energy expended: light physical activity (<3.5 kcal/min), moderate (3.5-7 kcal/min), and vigorous (>7 kcal/min).[15] A lack of physical activity over a certain period can lead to maladaptation of the body, such as the accumulation of fat in the abdominal area, which can increase the risk of hyperinsulinemia even in young individuals.[16] Additionally, physical activity enhances endurance and muscle strength. It contributes to the efficiency of the respiratory and circulatory systems, thereby improving the supply of oxygen and nutrients to the organs, including the brain.[17]

The results of this study indicate that students with low physical activity levels are significantly more numerous than those with high activity levels. The p-value for the relationship between physical activity and lumbar flexibility is 0.661, which is not substantially different from previous research that reported a p-value of 0.628.[18.] These results indicate no significant relationship between physical activity and lumbar flexibility among the respondents in this study.

Low physical activity levels among physiotherapy students can have long-term health implications, including an increased risk of musculoskeletal disorders and a decline in functional capacity. Additionally, low physical activity can affect academic performance due to reduced cognitive capacity and energy levels. These findings highlight the importance of promoting physical activity within the educational environment to enhance the overall well-being of physiotherapy students.

Sedentary behavior is characterized by minimal physical activity in daily life.[19] The term "Sedentary Lifestyle" refers to a tendency toward a passive lifestyle often associated with habits of idleness.[20] This lifestyle can increase the risk of obesity and overweight, resulting from a combination of genetic and environmental factors, including a lack of physical activity.[21]

In this study, 46 individuals (29.9%) had a low level of sedentary lifestyle, 51 individuals (33.1%) were categorized as moderate, and 57 individuals (37%) had a high sedentary lifestyle. Previous research found that approximately 80.95% of respondents did not meet the recommended physical activity levels, indicating a high prevalence of a sedentary lifestyle.[3] The analysis results showed a p-value of 0.130, indicating a weak relationship between a sedentary lifestyle and lumbar flexibility.

Prolonged sitting can cause excessive pressure on the lower back muscles, which risks muscle fatigue and a loss of lumbar flexibility. Additional strain from a static position, poor posture, or non-ergonomic seating can exacerbate musculoskeletal disorders.[22] Furthermore, high academic demands, a lack of awareness regarding the importance of good posture, and minimal stretching activities can decrease lumbar flexibility among physiotherapy students.

This study has several limitations that should be noted. First, data collection relied solely on questionnaires, which may introduce subjective bias as respondents reported their physical activity over the past seven days. Second, the sample used in this study was limited to students from a single university, making it difficult to generalize the findings to the entire student population in Indonesia. This study did not consider other confounding variables that could influence lumbar flexibility, such as organized exercise habits, sitting posture, or genetic factors. Finally, the subjectivity of respondents in recalling and reporting their physical activity may lead to recall bias, potentially affecting the validity of the study's results.

The lack of a significant relationship between physical activity and lumbar flexibility may be attributed to several factors, including the field test-based measurement of flexibility that does not account for individual biomechanical aspects. Moreover, the sample's variability in physical activity levels may also influence the outcomes.

Biological and socio-cultural factors may also impact lumbar flexibility. Most respondents in this study were female, who tend to have better flexibility than males due to hormonal differences. The academic environment and curriculum may also play a role in the physical activity patterns of physiotherapy students, mainly through high academic demands that limit time for exercise.

Although this study provides insights into the relationship between physical activity, sedentary lifestyle, and lumbar flexibility among physiotherapy students at Universitas Muhammadiyah Surakarta, these findings may not necessarily be generalized to students from other programs or universities. The unique characteristics of physiotherapy students, such as exposure to health science and body anatomy, may influence the results of this research. Additionally, cultural factors and physical activity patterns in Indonesia may also affect the findings compared to studies conducted in other countries.

Several recommendations can be considered to enhance the validity and scope of future research. First, involving students from various universities would increase external validity and allow for the generalization of findings to a broader population. Second, using objective methods such as accelerometers or wearable devices could provide more accurate measurements of physical activity and reduce subjective bias that may arise from questionnaire usage. Furthermore, subgroup analyses based on gender or specific physical activity levels could offer deeper insights into particular factors affecting lumbar flexibility. Finally, extending the duration of the study would allow for monitoring changes in flexibility over a more extended period, revealing the long-term effects of a sedentary lifestyle. By implementing these recommendations, future research is expected to provide a more comprehensive understanding of the factors influencing lumbar flexibility and the implications of physical activity for physiotherapy students.

Conclusion

This study reveals that most 2021 physiotherapy students at Universitas Muhammadiyah Surakarta have low physical activity levels, with 64.9% of respondents classified in the low physical activity category. The analysis shows no significant relationship between physical activity and lumbar flexibility, with a p-value of 0.661. Additionally, 37% of respondents exhibited a high sedentary lifestyle, which may negatively impact their long-term health and academic performance. Limitations of this study include data collection using only questionnaires and focusing on students from a single university, which restricts the generalization of results. Therefore, for future research, it is recommended to involve respondents from various universities, use more objective measurement methods, and consider other factors that may influence lumbar flexibility. This study emphasizes the importance of promoting physical activity in academic environments to enhance physiotherapy students' overall health and well-being.

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